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09/693,012	10/19/2000	David G. Boyers	101900	7407

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EXAMINER	
WINTER, GENTLE E	
ART UNIT	PAPER NUMBER
1746	9

DATE MAILED: 01/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/693,012	BOYERS ET AL.	
	Examiner	Art Unit	
	Gentle E. Winter	1746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 November 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-119* is/are pending in the application.

4a) Of the above claim(s) *30,40-115 and 117-119* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-29,31-39 and 116* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *30,40-115 and 117-119* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112--Withdrawn

1. Claims 8-11 and 14-16 rejected under 35 U.S.C. 112, second paragraph, as being indefinite. Applicant's amendment have obviated the rejection(s).

Art Rejections--Moot

2. Applicant's arguments with respect to claims 1-29, 31-39 and 116 have been considered but are moot in view of the new ground(s) of rejection.

Substitute Specification

3. The substitute pages were not accompanied by a marked copy showing the changes introduced by the amendment(s). The entry of the substitute pages is held in abeyance pending the receipt of a marked copy showing what changes appear in the substitute pages. Applicant's request for deferment of making the indicated corrections is reasonable and, of course, is acceptable.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-7, 12, 17, 19-20, 22-29, and 31-36 and 8-11, 13-14, 16, 18, 37-39, and 116 are rejected under 35 U.S.C. 102(e) as being anticipated by United States Patent No. 6,406,551 ('551) to Nelson.

6. With specific respect to claim 1, drawn to a method for treating/oxidizing (oxidizing the substrate surface) a material, comprising: forming an ozone solvent solution at a first temperature; and reacting the ozone solvent solution with the material at the second temperature; wherein the first temperature is less than a second temperature, the relatively lower first temperature facilitating an increased concentration of dissolved ozone in the solvent, the relatively higher second temperature facilitating an increased reaction rate between the ozone solvent solution and the material. The claim is read on by the '551 reference, as follows. The '551 reference is drawn to a method for treating a material (disclosed as a method of treating a substrate see e.g. column 16, line 9 *et seq.*), comprising: forming an ozone solvent solution at a first temperature (disclosed as causing a processing liquid, explicitly disclosed to be an ozone solution at column 16, line 24 *et seq.* naturally it is formed at a temperature; and reacting the ozone solvent solution with the material at the second temperature (disclosed as causing the processing liquid to contact a heated substrate see e.g. column 16, line 9 *et seq.*); wherein the first temperature is less than a second temperature, (as discussed above the solution is applied to the heated substrate) the relatively lower first temperature facilitating an increased concentration of dissolved ozone in the solvent, the relatively higher second temperature facilitating an

increased reaction rate between the ozone solvent solution and the material are inherent and taught in e.g. column 15, line 36 *et seq*.

7. With specific respect to claims 2-5, the heated liquid is disclosed to be at a temperature of from about 30 degrees Celsius to 1 degree below boiling (in the disclosed case of water, this would correspond to 99 degrees Celsius) see e.g. column 7, line 40 *et seq*. The ozone solution is disclosed to be at a substantially ambient temperature. With specific respect to claims 4, 5, and 34, "substantially ambient" includes a temperature of 25 degrees Celsius and 25 degrees Celsius is between 1-30 degrees Celsius. Reference '551 discloses "chilling the processing liquid to a temperature of from about 1 degree Celsius to about 20 degrees Celsius." See e.g. column 7, line 40 *et seq*.

8. With specific respect to claims 6 and 7, the heated liquid is disclosed to be at a temperature of from about 30 degrees Celsius to 1 degree below boiling (in the disclosed case of water, this would correspond to 99 degrees Celsius) see e.g. column 7, line 40 *et seq*. The ozone solution is disclosed to be at a substantially ambient temperature. With specific respect to claims 4, 5, and 34, "substantially ambient" includes a temperature of 25 degrees Celsius and 25 degrees Celsius is between 1-30 degrees Celsius. Reference '551 discloses "chilling the processing liquid to a temperature of from about 1 degree Celsius to about 20 degrees Celsius." See e.g. column 7, line 40 *et seq*.

9. With specific respect to claims 8, and 9. '551 discloses the step of heating the ozone solvent solution from the cooler first temperature to the warmer second temperature and applying solution to the wafer at the second temperature. Specifically, at column 8, line 23 *et seq.* '551 discloses that a heated liquid and the processing liquid (disclosed in the specification as an ozone solvent solution) may be caused to contact the substrate simultaneously.... The simultaneous application of the fluids necessarily would result in, at least a partial mixing, and associated heat exchange, of the fluids prior to actual delivery to the surface of the substrate. If the solutions are not applied simultaneously (see e.g. column 8, line 23 *et seq.* '551) than the wafer is warmed and the solution, at the time of contact is heated, resulting in a supersaturated solution, and/or the ozone coming out of solution. In either case the concentration is higher than it would have been if the solution were to have been formed at the higher temperature.

10. With specific respect to claims 10 and 11, seemingly, by heating the ozone directly at the surface of the wafer the decrease in concentration would be minimal, and certainly less than 20%. As time progressed, of course the concentration would fall, but at the time of application the concentration would be no more than 20%.

11. With specific respect to claim 12, nozzles for fluid delivery are disclosed throughout see e.g. element 22 of figures 1 and 2, and associated text.

12. With specific respect to claim 13, the step of immersion is not explicitly identified as such. However, language of '551 discloses submersion under a flowing liquid. Specifically,

'551 discloses: [t]he processing liquid may be caused to contact the substrate in any manner by which the processing liquid may come into contact with the area of the substrate that is to be treated. And goes on to teach: the processing liquid is caused to flow across at least one surface of the substrate, i.e., by cascading the processing liquid onto the substrate from a processing liquid source, by causing a substantially continuous fluid stream of the heated liquid to contact the substrate. Notwithstanding the failure of the '551 reference to explicitly identify a submersion step *per se* the teaching of cascading liquid is construed to be a form of submersion. A clarification that of exactly what is meant by submersion may be helpful. Absent such a clarification, the term may be accorded a meaning for the purposes of claim construction in making a determination of patentability.

13. With specific respect to claim 14. The '551 reference discloses the step of heating the ozone solvent solution from the cooler first temperature to the warmer second temperature and applying solution to the wafer at the second temperature. Specifically, at column 8, line 23 *et seq.* '551 discloses that a heated liquid and the processing liquid (disclosed in the specification as an ozone solvent solution) may be caused to contact the substrate simultaneously.... The simultaneous application of the fluids necessarily would result in, at least a partial mixing, and associated heat exchange, of the fluids prior to actual delivery to the surface of the substrate. If the solutions are not applied simultaneously (see e.g. column 8, line 23 *et seq.* '551) than the wafer is warmed and the solution, at the time of contact is heated, resulting in a supersaturated solution, and/or the ozone coming out of solution. In either case the concentration is higher than it would have been if the solution were to have been formed at the higher temperature.

14. With specific respect to claim 16, disclosing the ozone-solvent solution is heated during the step of applying said zone-solvent solution to said material, at e.g. column 8, line 23 *et seq.* '551 discloses that a heated liquid and the processing liquid (disclosed in the specification as an ozone solvent solution) may be caused to contact the substrate simultaneously.... The simultaneous application of the fluids necessarily would result the ozone-solvent solution being heated during the step of applying said zone-solvent solution to said material.

15. With specific respect to claim 17, the injection of a chemical is disclosed *inter alia* at column 6, line 38 *et seq.* disclosing that the processing liquid utilized in the method of the '551 invention comprises *inter alia* a chemical employed in the processing liquid, including, but not limited to, acids, bases, detergents, (which inherently include surfactants) etchants, oxidants, cleaning agents, stripping agents, catalysts, enhancing agents, combinations of these, and the like. Water is within the ambit of what is considered a chemical.

16. With specific respect to claim 18, while potentially not explicitly disclosed in '551, the limitation of claim 18 are inherently present. Water is a chemical (i.e. ultra pure deionized water). The mixing at the wafer (substrate) surface resulting from simultaneous application of the solutions would be contemplated. Additionally, '551 discloses the heated liquid may be any liquid that is capable of being heated to a temperature effective to transfer the desired level of heat, either radiantly, convectively, conductively, or via condensation on a surface, to the substrate(s) to be treated in accordance with the method of the present invention. Furthermore,

the temperature of the heated liquid is not restricted, but rather, the heated liquid can be heated to any temperature at which the heated liquid remains a liquid, i.e., to any temperature below the boiling point of the heated liquid, so that the ability to cause directed uniform heating of one or more substrates via the application of one or more streams of heated liquid is retained.

17. With specific respect to claim 20, the injection of a chemical is disclosed *inter alia* at column 6, line 38 *et seq.* disclosing that the processing liquid utilized in the method of the '551 invention comprises *inter alia* a chemical employed in the processing liquid, including, but not limited to, acids, bases, detergents, (which inherently include surfactants) etchants, oxidants, cleaning agents, stripping agents, catalysts, enhancing agents, combinations of these, and the like.

18. With specific respect to claim 22, the injection of a chemical is disclosed *inter alia* at column 6, line 38 *et seq.* disclosing that the processing liquid utilized in the method of the '551 invention comprises *inter alia* a chemical employed in the processing liquid, including, but not limited to, acids, bases, detergents, (which inherently include surfactants) etchants, oxidants, cleaning agents, stripping agents, catalysts, enhancing agents, combinations of these, and the like.

19. With specific respect to claim 23, '551 discloses causing the processing liquid to contact a heated substrate see e.g. column 16, line 9 *et seq.*); wherein the first temperature is less than a second temperature, (as discussed above the solution is applied to the heated substrate) the

relatively lower first temperature facilitating an increased concentration of dissolved ozone in the solvent, the relatively higher second temperature facilitating an increased reaction rate between the ozone solvent solution and the material are inherent and taught in e.g. column 15, line 36 *et seq*.

20. With specific respect to claims 24-29, '551 discloses applying the zone solution to the substrate and rotating same about a central axis see e.g. column 18, line 20 *et seq*. Also see e.g. column 15 and associated tables. The rinsing step is disclosed throughout see e.g. column 11, line 41 *et seq*. Semiconductor wafers are disclosed throughout '551 as a substrate, see e.g. column 3, line 5 *et seq*. More specifically with particular respect to claim 27, it is well settled in the cleaning arts that the cleaning solution is rinsed off. To explicitly claim such a step, implicitly suggests that the step is not necessarily present in the independent claim. While it appears unambiguously clear that a rinsing step is disclosed, if applicant argues that the step is not identically disclosed, than it is inherently present, see e.g. Machino et al. (discussed below) at e.g. column 26, line 47.

21. With specific respect to claim 31, drawn to a method for treating/oxidizing (oxidizing the substrate surface) a material, comprising: forming an ozone solvent solution at a first temperature; and reacting the ozone solvent solution with the material at the second temperature; wherein the first temperature is less than a second temperature, the relatively lower first temperature facilitating an increased concentration of dissolved ozone in the solvent, the relatively higher second temperature facilitating an increased reaction rate between the ozone

solvent solution and the material. The claim is read on by the '551 reference, as follows. The '551 reference is drawn to a method for treating a material (disclosed as a method of treating a substrate see e.g. column 16, line 9 *et seq.*), comprising: forming an ozone solvent solution at a first temperature (disclosed as causing a processing liquid, explicitly disclosed to be an ozone solution at column 16, line 24 *et seq.* naturally it is formed at a temperature; and reacting the ozone solvent solution with the material at the second temperature (disclosed as causing the processing liquid to contact a heated substrate see e.g. column 16, line 9 *et seq.*); wherein the first temperature is less than a second temperature, (as discussed above the solution is applied to the heated substrate) the relatively lower first temperature facilitating an increased concentration of dissolved ozone in the solvent, the relatively higher second temperature facilitating an increased reaction rate between the ozone solvent solution and the material are inherent and taught in e.g. column 15, line 36 *et seq.*

22. With specific respect to claim 32, '551 discloses applying the zone solution to the substrate and rotating same about a central axis see e.g. column 18, line 20 *et seq.* Also see e.g. column 15 and associated tables. The rinsing step is disclosed throughout see e.g. column 11, line 41 *et seq.* Semiconductor wafers are disclosed throughout '551 as a substrate, see e.g. column 3, line 5 *et seq.* It is well settled in the cleaning arts that the cleaning solution is rinsed off. To explicitly claim such a step, implicitly suggests that the step is not necessarily present in the independent claim. While it appears unambiguously clear that a rinsing step is disclosed, if applicant argues that the step is not identically disclosed, than it is inherently present, see e.g. Machino et al. (discussed below) at e.g. column 26, line 47.

23. With specific respect to claim 33 the heated liquid is disclosed to be at a temperature of from about 30 degrees Celsius to 1 degree below boiling (in the disclosed case of water, this would correspond to 99 degrees Celsius) see e.g. column 7, line 40 *et seq*. The ozone solution is disclosed to be at a substantially ambient temperature. With specific respect to claims 4, 5, and 34, "substantially ambient" includes a temperature of 25 degrees Celsius and 25 degrees Celsius is between 1-30 degrees Celsius. Reference '551 discloses "chilling the processing liquid to a temperature of from about 1 degree Celsius to about 20 degrees Celsius." See e.g. column 7, line 40 *et seq*.

24. With specific respect to claim 35, the heated liquid is disclosed to be at a temperature of from about 30 degrees Celsius to 1 degree below boiling (in the disclosed case of water, this would correspond to 99 degrees Celsius) see e.g. column 7, line 40 *et seq*. The ozone solution is disclosed to be at a substantially ambient temperature. With specific respect to claims 4, 5, and 34, "substantially ambient" includes a temperature of 25 degrees Celsius and 25 degrees Celsius is between 1-30 degrees Celsius. Reference '551 discloses "chilling the processing liquid to a temperature of from about 1 degree Celsius to about 20 degrees Celsius." See e.g. column 7, line 40 *et seq*.

25. With specific respect to claim 36, drawn to a method for treating/oxidizing (oxidizing the substrate surface) a material, comprising: forming an ozone solvent solution at a first temperature; and reacting the ozone solvent solution with the material at the second temperature;

wherein the first temperature is less than a second temperature, the relatively lower first temperature facilitating an increased concentration of dissolved ozone in the solvent, the relatively higher second temperature facilitating an increased reaction rate between the ozone solvent solution and the material. The claim is read on by the '551 reference, as follows. The '551 reference is drawn to a method for treating a material (disclosed as a method of treating a substrate see e.g. column 16, line 9 *et seq.*), comprising: forming an ozone solvent solution at a first temperature (disclosed as causing a processing liquid, explicitly disclosed to be an ozone solution at column 16, line 24 *et seq.* naturally it is formed at a temperature; and reacting the ozone solvent solution with the material at the second temperature (disclosed as causing the processing liquid to contact a heated substrate see e.g. column 16, line 9 *et seq.*); wherein the first temperature is less than a second temperature, (as discussed above the solution is applied to the heated substrate) the relatively lower first temperature facilitating an increased concentration of dissolved ozone in the solvent, the relatively higher second temperature facilitating an increased reaction rate between the ozone solvent solution and the material are inherent and taught in e.g. column 15, line 36 *et seq.*

26. With specific respect to claim 37, '551 discloses the step of heating the ozone solvent solution from the cooler first temperature to the warmer second temperature and applying solution to the wafer at the second temperature. Specifically, at column 8, line 23 *et seq.* '551 discloses that a heated liquid and the processing liquid (disclosed in the specification as an ozone solvent solution) may be caused to contact the substrate simultaneously.... The simultaneous application of the fluids necessarily would result in, at least a partial mixing, and associated heat

exchange, of the fluids prior to actual delivery to the surface of the substrate. If the solutions are not applied simultaneously (see e.g. column 8, line 23 *et seq.* '551) than the wafer is warmed and the solution, at the time of contact is heated, resulting in a supersaturated solution, and/or the ozone coming out of solution. In either case the concentration is higher than it would have been if the solution were to have been formed at the higher temperature.

27. With specific respect to claim 38, disclosing the ozone-solvent solution is heated during the step of applying said zone-solvent solution to said material, at e.g. column 8, line 23 *et seq.* '551 discloses that a heated liquid and the processing liquid (disclosed in the specification as an ozone solvent solution) may be caused to contact the substrate simultaneously.... The simultaneous application of the fluids necessarily would result the ozone-solvent solution being heated during the step of applying said zone-solvent solution to said material.

28. With specific respect to claim 39, the injection of a chemical is disclosed *inter alia* at column 6, line 38 *et seq.* disclosing that the processing liquid utilized in the method of the '551 invention comprises *inter alia* a chemical employed in the processing liquid, including, but not limited to, acids, bases, detergents, (which inherently include surfactants) etchants, oxidants, cleaning agents, stripping agents, catalysts, enhancing agents, combinations of these, and the like. Water is within the ambit of what is considered a chemical.

29. With specific respect to claim 116, '551 does not appear to explicitly identically disclose the step of moving the nozzles relative to the substrate. However '551 does disclose the step of

changing the angle with which the deionized water impinges on the substrate, see e.g. column 5, line 63 - column 6, line 1 *et seq.* The change in angle is construed to be movement relative to the substrate.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

30. Claim 15 are rejected under 35 U.S.C. 103(a) as being obvious over '551, in view of United States Patent No. 5,716,458 to Machino. Each and every element of claim 15 is identically disclosed in '551, as discussed above, except '551 fails to explicitly disclose that a heat exchanger or in-line heater may be used to provide the requisite heat. Although seemingly the heated water stream is heated with some heat exchanger. Such heating elements are disclosed in Machino. Machino discloses:

> [t]he heater 11 may comprise any of that type of heaters which directly heat the mixture 1 using electricity or other heat sources, or may comprise any of that type of heaters which indirectly heat the mixture 1 using, for example, a heat exchanger which provides heat exchange between the directly heated heat transfer medium and the mixture 1. (Column 5, line 57 *et seq.*)

The artisan would have been motivated to make the instant combination because such a combination obviates the need for transport heated liquid from a distant heater, and also minimizes thermal variation and waste during start-up. (Column 6, line 13 *et seq.*), as discussed above the heated plate will heat the liquid as it is applied to the wafer.

31. Claim 19, and 21 are rejected under 35 U.S.C. 103(a) as being obvious over the '551 in view of reference *Decomposition of Ozone in Aqueous Acetic Acid Solutions* by Sehested et al. Each and every limitation of claims 19 and 21 is identically disclosed by '551 as set forth above, except '551 may not explicitly disclose that the injected chemical comprise a hydroxyl radical scavenger and an acid. Sehested et al. disclose that "acetic acid is a well known stabilizer of aqueous ozone solutions, and that acetic acid is known to scavenge the OH radical, which is the chain propagating radical in ozone decomposition." Because it is desirable to avoid ozone decomposition (at least in solution) the artisan would have been motivated to make the instant combination.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gentle E. Winter whose telephone number is (703) 305-3403. The examiner can normally be reached on Monday-Friday, 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy P. Gulakowski can be reached on (703) 308-4333. The fax phone numbers for

the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Gentle E. Winter
Examiner
Art Unit 1746

January 13, 2003

RANDY GULAKOWSKI
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700